

# Now what? Surveillance options to monitor low pathogenicity avian influenza (LPAI) disease progression in a poultry flock and implications for monitoring diseases where animals can recover

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# Introduction

- Flocks participating in the National Poultry Improvement Plan are regularly screened for H5/H7 LPAI
- Surveillance protocols are at the discretion of the states, but conform to standards in CFR § **145.15**
- The official determination of a flock as positive for the H5 or H7 subtypes of avian influenza made only by NVSL.



# Introduction

- Options for marketing or disposal of LPAI infected flocks are important to provide flexibility to risk managers
- Off-site disposal or marketing may be advantageous in specific situations
  - e.g., controlled slaughter, rendering, off-site burial, landfill
  - Reduced disposal cost, recovery of valuable protein
- Off-site disposal may represent a risk for disease transmission from the farm or during transport



# Objectives

- Evaluate the value of diagnostic tests to monitor the stage of LPAI infection in broiler-breeders and predict:
  - Remaining duration of virus shedding in the flock
  - Prevalence of infectious and seropositive birds
- Discuss the application of the results to inform decisions pertaining to disposal or marketing of LPAI infected flocks
- Consider potential applicability in other animal species-disease pairings where animals are likely to recover



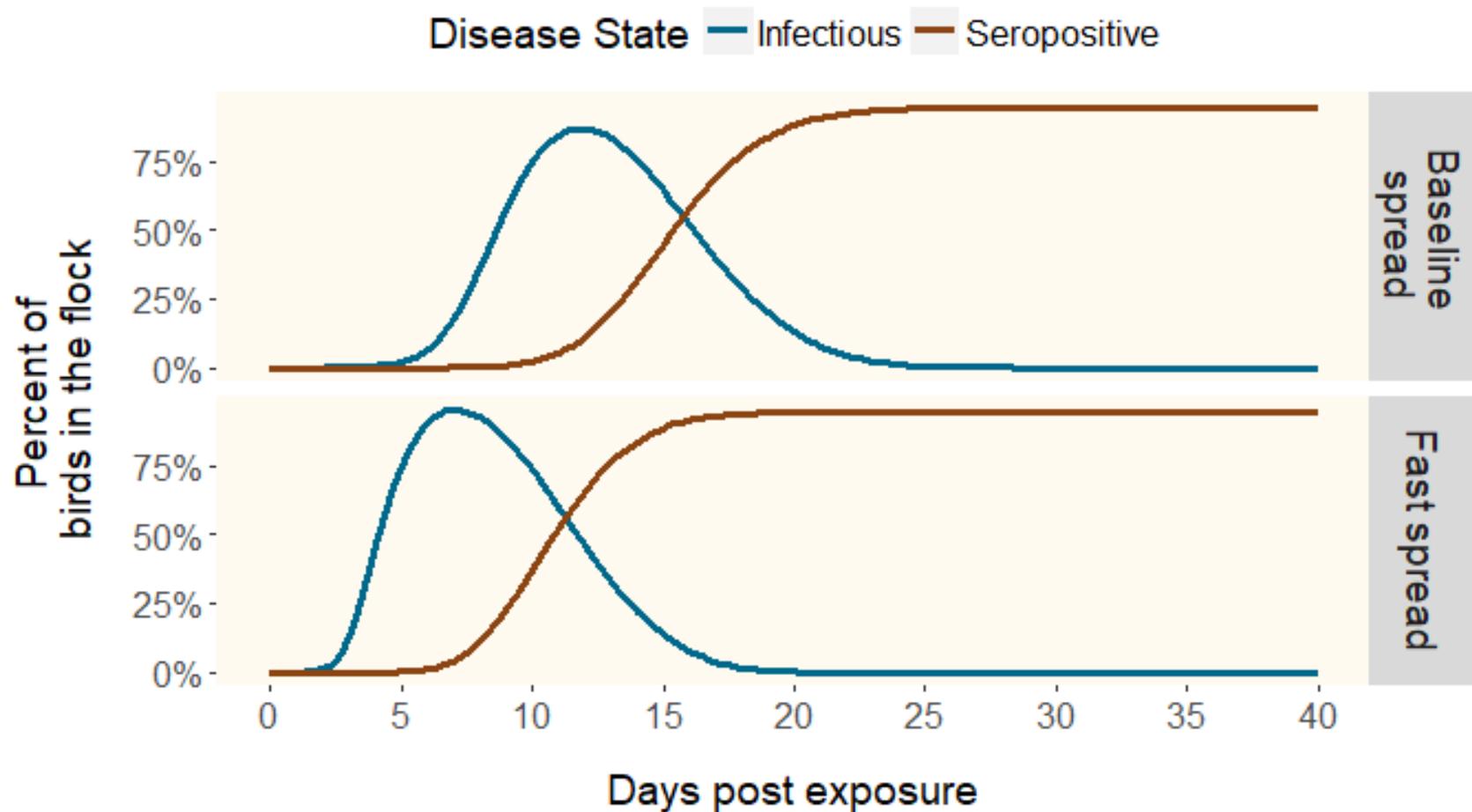
# Surveillance Protocol Options for Monitoring an LPAI Infected Flock after Initial Detection

- Serological tests alone
  - 30 samples per-house are tested by AGID
- Serological tests in combination with rRT-PCR tests<sup>1</sup>
  - 30 samples per-house are tested by AGID
  - 3 pooled samples of 11 oropharyngeal swabs per-house are tested with rRT-PCR
    - Available dead birds swabbed first, followed by live birds as necessary to get 33 swabs
  - Assumed that test day could be 1-65 days post flock exposure

<sup>1</sup> Personal communication, Mia Torchetti, Carol Cardona, Dave Halvorson



# Prevalence of Infectious and Seropositive Birds Over Time: Within-Flock Disease Spread Model

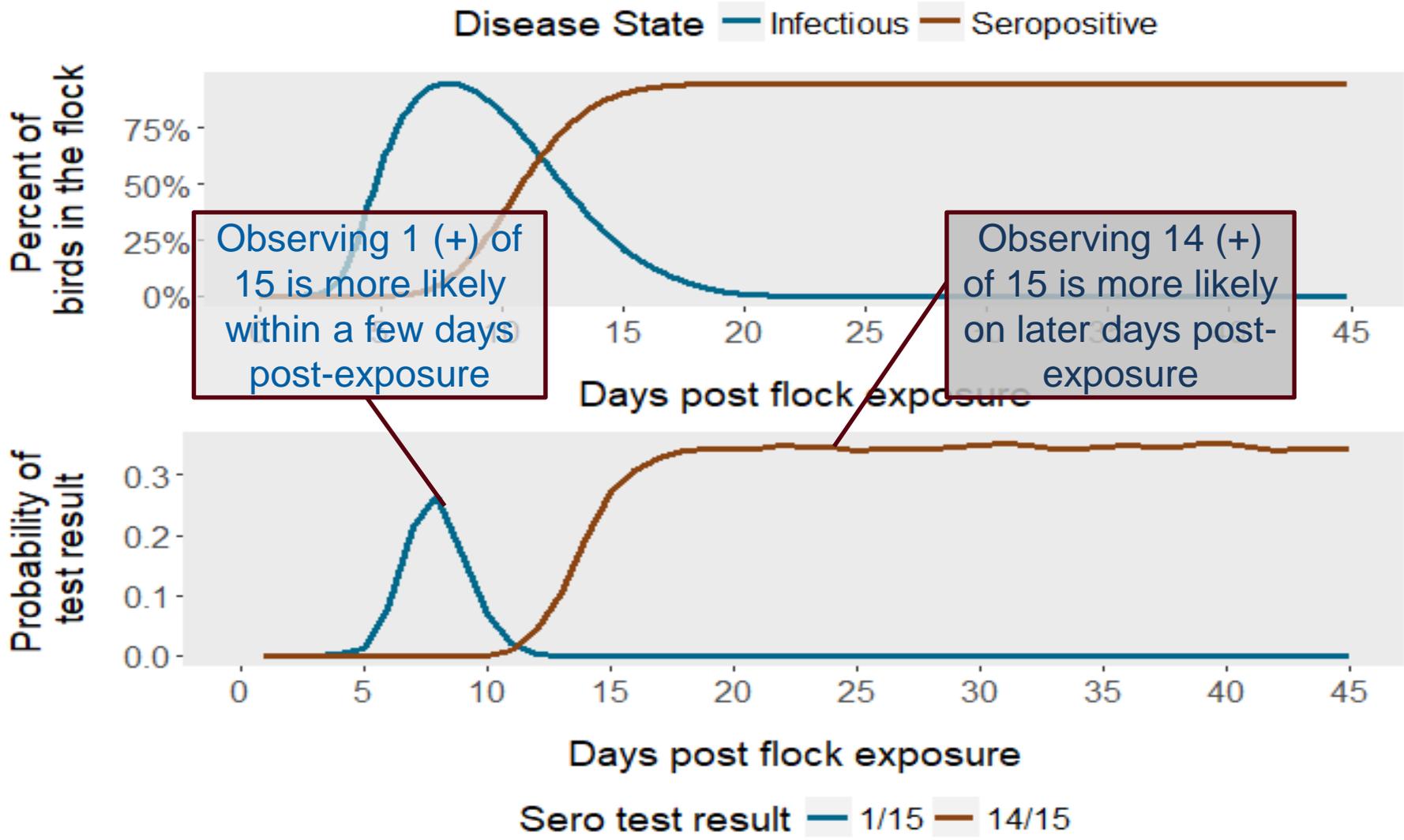


# Useful model outputs- where are we in the spread of virus throughout the flock?

- Provides a snapshot of disease progression:
  - What proportion of AGID tests are positive at a given time?
  - What proportion of PCR pools are positive at a given time?
- Assess the stage of LPAI disease progression and predict:
  - Remaining duration of virus shedding in the flock (house)
  - Prevalence of infectious and seropositive birds



# Probability of Observing a Specific Number of Positive AGID Test Results Over Time in the Fast Spread Scenario

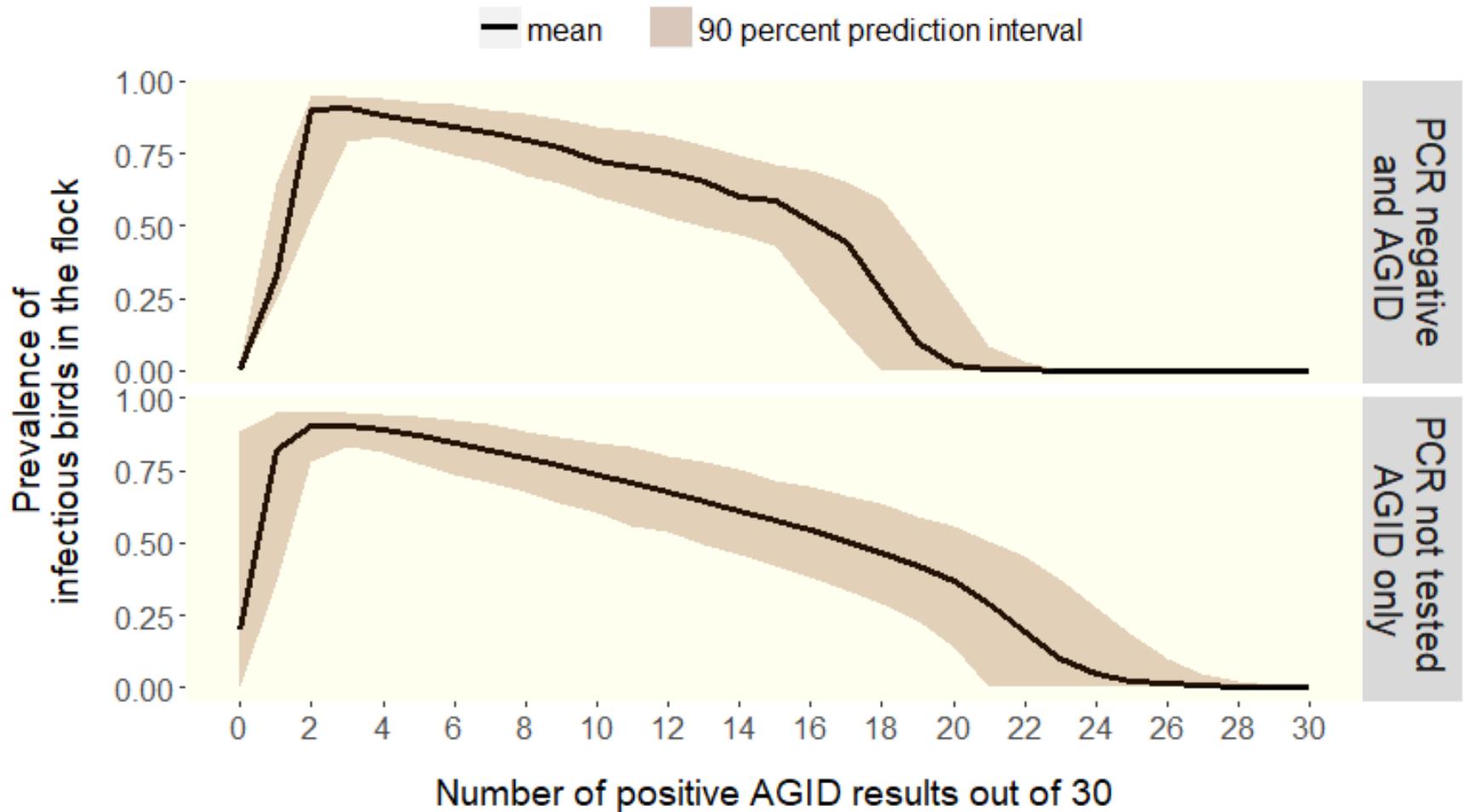


# What proportion of birds are currently shedding?

- Would you want to bring a depop crew in now?
- How about move birds down the road?
- 3 pooled samples of 11 oropharyngeal swabs per-house are tested with rRT-PCR



# Prevalence of Infectious Birds in the Flock Given AGID Test Results and rRT-PCR Test Results (Baseline Contact Rate)

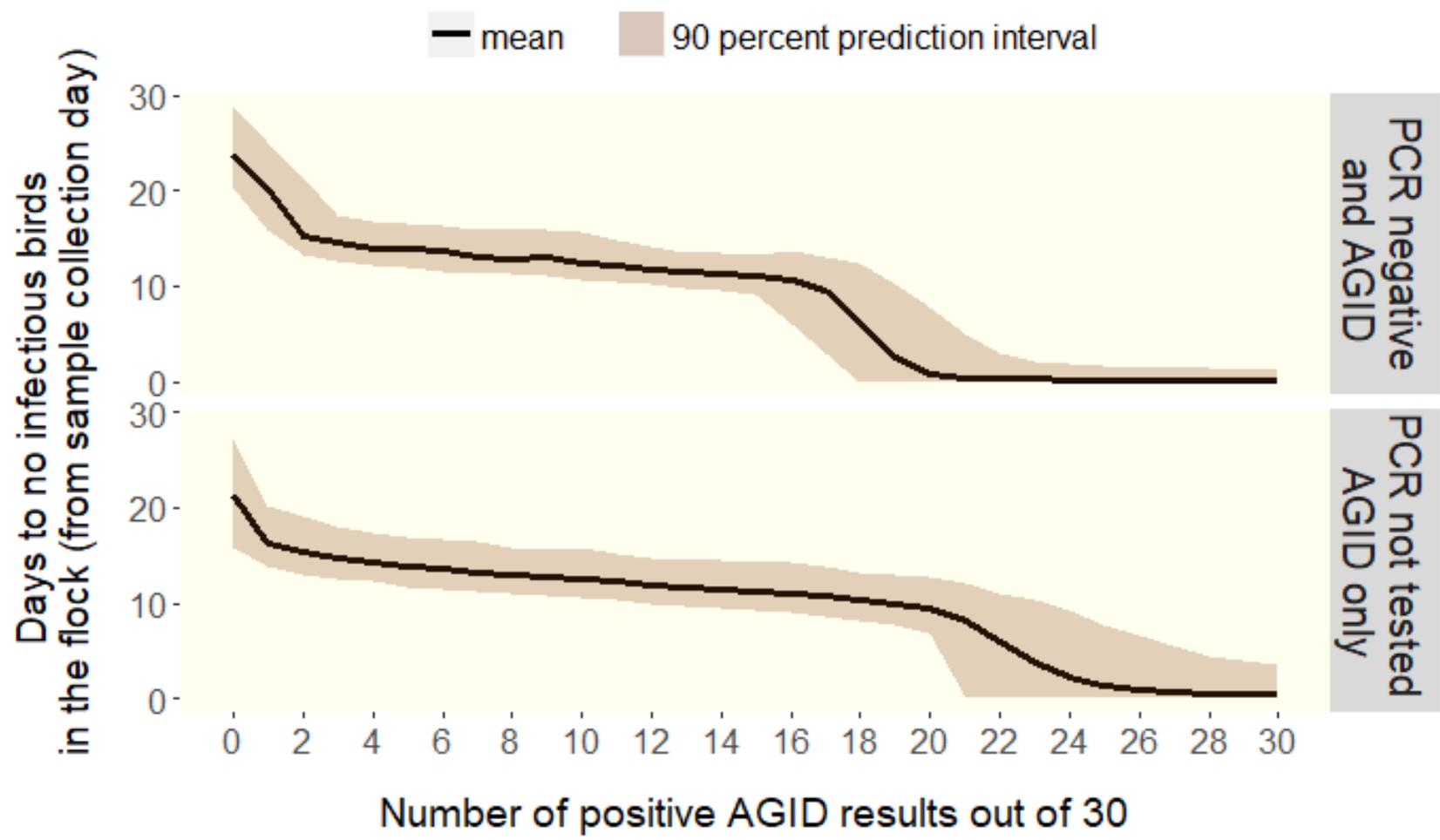


# When will the flock stop shedding?

- Depends on contact rate— faster spread means entire flock will be infected sooner and seroconvert sooner relative to a slower contact rate
- Monitoring both seroconversion and PCR can tighten the predicted interval when you can say shedding will no longer be significant risk.



# Number of Days to Stop Shedding (After Test Day) Given AGID Test Results and rRT-PCR Test Results (Baseline Contact Rate)



# Results Summary

- Diagnostic testing is valuable to establish the stage of disease progression in LPAI infected flocks
- A high proportion of positive serological tests (AGID) indicates
  - A shorter remaining duration of shedding
  - Fewer actively shedding birds at the time of testing
  - A higher proportion of recovered birds
- A combination of rRT-PCR and serological (AGID) testing can reduce the uncertainty in the estimated remaining duration of virus shedding



# Future Work (1): Economic Considerations for Off-site Disposal Options

- Composting broiler breeder flocks can be difficult depending on house design and potentially increases downtime for premises
- Cost and availability of carbon sources are not consistent
- Off-site disposal or marketing options may be advantageous in specific situations to reduce disposal costs
  - The value of rendered or marketed birds may partially offset transportation costs
  - Alternative marketing channels can potentially utilize protein

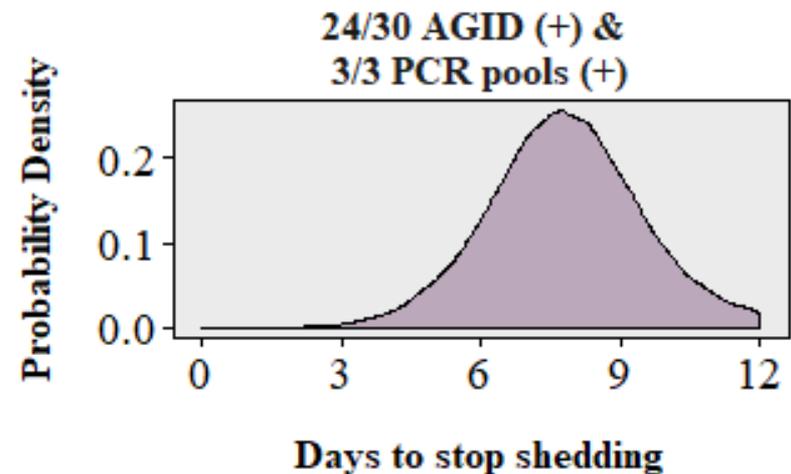
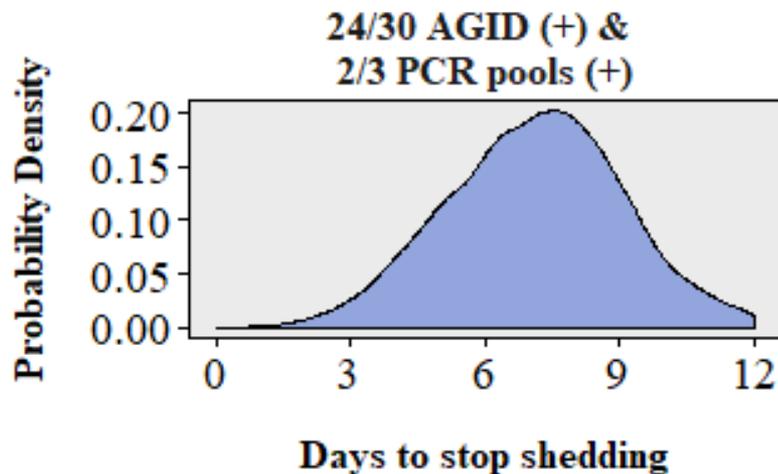
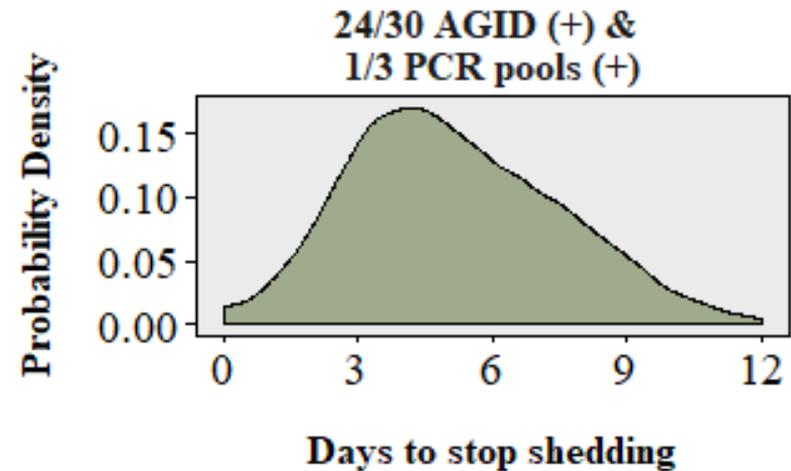
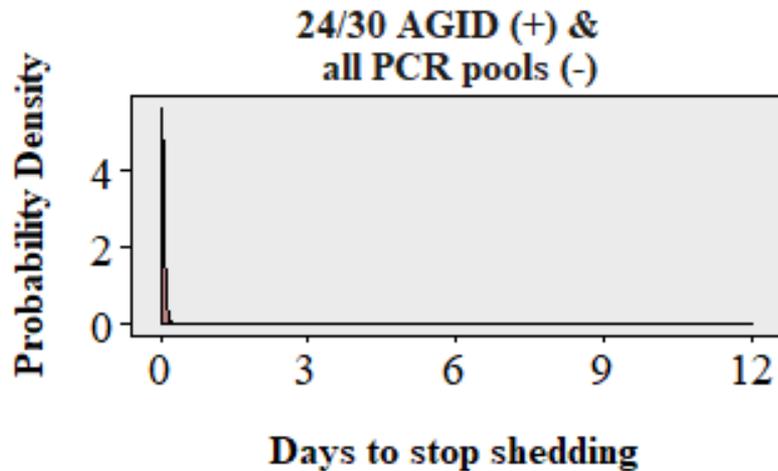


## Future Work (2): Other animal-pathogen combinations

- Foot and Mouth Disease in ruminants, swine
  - Virulent Newcastle Disease in vaccinated poultry
  - PRRSV in swine
  - Senecavirus A in swine
  - Influenza A Virus of Swine
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- Additional surveillance tools, such as lesion aging or presence of clinical signs



# Example: Value of Combining AGID results with Number of PCR (+) Pooled Samples (Baseline Contact Rate)



# Conclusion

- A combination of antigen and antibody tests can be useful to establish the stage of LPAI infection and inform disposal or marketing options along with other risk management considerations
- LPAI in poultry is a potential model for developing disease progression models in other species-pathogen combinations where animals can recover





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# Thank You

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